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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte JENS GUHRING and AXEL SCHREIBER

Appeal 2011-000078
Application 11/355,338
Technology Center 2600

Before JOSEPH F. RUGGIERO, DENISE M. POTHIER,
and JAMES B. ARPIN, *Administrative Patent Judges*.

POTHIER, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

Appellants appeal under 35 U.S.C. § 134(a) from the Examiner's rejection of claims 1, 3-5, and 7-14. Claims 2 and 6 have been canceled. App. Br. 1.[1] We have jurisdiction under 35 U.S.C. § 6(b). An oral hearing was conducted on January 15, 2013. We affirm.

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[1] Throughout this opinion, we refer to the Appeal Brief (App. Br.) filed May 11, 2010, the Examiner's Answer (Ans.) mailed July 8, 2010, and the Reply Brief (Reply Br.) filed September 2, 2010.

Invention

Appellants' invention relates to a three-dimensional (3D) visualization of vectorial quantities using color-coded direction information. *See* Abstract. Illustrative claim 1 is reproduced below with bracketing and emphasis added:

1. A method for visualization of three-dimensional vectorial quantities at a data processor, comprising the steps of:

[a] supplying a data processor with data obtained from diffusion tensor imaging of a diffusion process in an examination subject with a magnetic resonance imaging system;

[b] at an image output associated with said data processor, *said data processor automatically electronically causing said vectorial quantities to be represented in respectively different direction-dependent colors in a multi-dimensionally projected color-coded representation, including an indication with said direction-dependent colors of a direction of said diffusion process, as one of said vectorial quantities*;

[c] generating said multi-dimensionally projected color coded representation to comprise primary directions, and color coding said primary directions respectively with primary colors; and

[d] said processor also, together with said multi-dimensionally projected representation at said image output, automatically visually representing at least one reference element indicating an orientation of said representation with respect to a system of multiple direction-indicating axes and at least one explanatory specification for said color coding, said at least one reference element visually indicating said orientation of said representation in terms of color as a three-dimensional element that is automatically generated by a program stored in said data processor, and said reference element having a color design that visually correlates the color coding of said representation to said axes, thereby making said reference element a combination of said specification of said orientation and a three-dimensional explanation of said color coding in a single reference element.

The Examiner relies on the following as evidence of unpatentability:

Fenster	US 5,964,707	Oct. 12, 1999
Laidlaw	US 2003/0234781 A1	Dec. 25, 2003
Schrag	US 2005/0028111 A1	Feb. 3, 2005

Gordon Kindlmann & David Weinstein, *Hue-Balls and Lit-Tensors for Direct Volume Rendering of Diffusion Tensor Fields*, PROC. CONF. ON VISUALIZATION 249-53 (1999).

Brian P. Witwer et al., *Diffusion-Tensor Imaging of White Matter Tracts in Patients With Cerebral Neoplasm*, 97 J. NEUROSURGERY 568-75 (2002).

Melanie Tory et al., *Combining 2D and 3D Views for Orientation and Relative Position Tasks*, 6 PROC. SIGCHI CONF. ON HUM. FACTORS COMPUTING SYS. 73-80 (2004).

The Rejection

Claims 1, 3-5, and 7-14 are rejected under 35 U.S.C. § 103(a) as unpatentable over Laidlaw, Kindlmann, Schrag, Tory, Witwer, and Fenster. Ans. 4-21.

THE CONTENTIONS

Regarding illustrative claim 1, the Examiner finds that Laidlaw teaches all of the claimed elements, except for elements [c] and [d]. Ans. 4-7. The Examiner relies upon the remaining references in combination with Laidlaw to teach the various features found in elements [c] and [d]. Ans. 7-11. For example, the Examiner relies upon: (1) Kindlmann for visualizing unit-length vectors using a color map that maps direction to a color and specifies orientation and explanation of the color (Ans. 25-26); (2) Witwer for mapping anistotropic orientations to red, green, and blue (i.e., the recited primary colors) (Ans. 26); (3) Schrag for including a 3D figure with text components or visual cues indicating direction (i.e., the recited explanatory specification for color coding) (*id.*); (4) Tory to teach that primary directions are color coded to indicate orientation of cutting plane (*id.*); and (5) Fenster

to explain a multi-dimensional projected representation comprising primary colors (Ans. 26-27).

Appellants first argue that the number of references cited by the Examiner (i.e., six references) and the lengthy explanation of how to combine the references is evidence that the Examiner is using impermissible hindsight and that the claimed invention is non-obvious. *See* App. Br. 7-8; Reply Br. 2-5. Appellants next argue that Laidlaw teaches 3D vectors processed using a "thread and halo" presentation, which has no association with color and teaches away from using color association. App. Br. 13-14. When discussing paragraph 0141 of Laidlaw, Appellants argue that Laidlaw: (1) does not disclose colors that are associated with anisotropic directions but only indicate the anisotropy type (App. Br. 15); (2) does not discuss colors associated with directions of a vectorial quantity (App. Br. 16); and (3) already uses colors to provide information other than direction information and cannot be modified to represent direction information (*id.*). Appellants present further arguments concerning the remaining cited references. App. Br. 16-19.

ISSUES

(1) Has the Examiner engaged in impermissible hindsight in rejecting claim 1 based on the teachings of Laidlaw, Kindlmann, Schrag, Tory, Witwer, and Fenster?

(2) Under § 103, has the Examiner erred in rejecting claim 1 by finding that Laidlaw, Kindlmann, Schrag, Tory, Witwer, and Fenster collectively would have taught or suggested a data processor causing the vectorial quantities to be represented in respectively different

direction-dependent colors in a multi-dimensionally projected color-coded representation, including an indication with the direction-dependent colors of a direction of the diffusion process, as one of the vectorial quantities ("element [b]")?

ANALYSIS

Based on the record before us, we find no error in the Examiner's rejection of illustrative claim 1.

Impermissible Hindsight

Just as both the Examiner (Ans. 22-23) and Appellants agree (Reply Br. 3), we are not convinced that relying on six references to formulate the § 103 rejection demonstrates that claim 1 is non-obvious. *See In re Gorman*, 933 F.2d 982, 986 (Fed. Cir. 1991). Appellants argue, however, that as the number of references increases, the evidence demonstrating obviousness necessarily diminishes. Reply Br. 3. We do not agree with this generalization. For example, *Gorman* discusses several cases where many references (e.g., eight) were cited and still supported a finding of unpatentability. *See Gorman*, 933 F.2d at 986. Rather, the criterion to determine nonobviousness should focus "not [on] the number of references, but what they would have meant to a person of ordinary skill in the field of the invention." *See id.*

Appellants further argue (App. Br. 7-8, 12-13; Reply Br. 4) that the number of pages required by the Examiner to explain her position (e.g., 7 ½ pages) and the insights gleaned from the references could only be achieved with "the benefit of reading Appellants' disclosure and claims." Reply

Br. 4. Notably, claim 1 itself is over one page in length. Thus, any explanation of the cited references addressing these elements will necessarily require some length to explain their teachings and why combining their teachings would have been obvious. Also, *Gorman* does not indicate that the length of the explanation evinces that impermissible hindsight has been used in formulating an obviousness rejection. *See Gorman*, 933 F.2d at 986.

Also, we acknowledge that "[i]t is impermissible . . . simply to engage in a hindsight reconstruction of the claimed invention, using the applicant's structure as a template and selecting elements from references to fill the gaps." *See id.* at 987. Yet, as explained below, we find that the Examiner has not simply used Appellants' disclosure as a template and has provided an explanation of each reference's teachings whereby combining the teachings would have rendered claim 1 obvious. *See* Ans. 4-11, 25-27. On the other hand, Appellants have not adequately rebutted (*see* App. Br. 7-19) how the Examiner's combination of the references (especially Witwer, Tory, and Fenster) having familiar elements would have done no more than yield predictable results and, thus, would have rendered claim 1 obvious to one of ordinary skilled in the art.

Specific Arguments Related to the References

1. Laidlaw

While not discussing claim limitations directly (App. Br. 13-16), we presume that Appellants are asserting that Laidlaw fails to teach the recited data processor automatically electronically causing the vectorial quantities to be represented in respectively different direction-dependent colors in a

multi-dimensionally projected color-coded representation, including an indication with the direction-dependent colors of a direction of the diffusion process, as one of the vectorial quantities. Appellants admit that Laidlaw discusses a 2D barycentric transfer function emitted as a color and opacity based on diffusion anisotropy but contend Laidlaw does not provide an indication of the direction in a 3D quantity at a specific location. App. Br. 14. We disagree for the following reasons.

Appellants argue that Laidlaw teaches 3D vectors processed using a "thread and halo" presentation, which has no association with color and teaches away from using color association. App. Br. 13-14. While we concur that Laidlaw discusses a "thread and halo" presentation (*see* Ans. 5 (citing ¶¶ 0043, 0141), 32; *see also* ¶ 0045), we disagree that Laidlaw has no association with color and teaches away from a color association. As the Examiner notes (Ans. 5, 31), Laidlaw discusses using a specified color (e.g., blue, red, and green) in the direct-volume-rendered layer through a transfer function based on anistropy metrics (¶ 0141; Fig. 10) and, thus, has some relation with color. This first layer is used in the volumetric rendering system to provide anatomical context for the remainder of the features. *See* ¶¶ 0067, 0141; Fig. 10. Additionally, Laidlaw discusses the second (thread texture) and third (halos) layers have colors to show speed or vortex lines. ¶¶ 0142, 0148-50; Figs. 11-12. Thus, we disagree with Appellants (App. Br. 13-14) that the "thread and halo" presentation in Laidlaw is not associated with color and teaches away from color association.

Moreover, Laidlaw teaches or suggests "vectorial quantities" are "represented in respectively different direction-dependent colors in a multi-dimensionally projected color-coded representation, including an indication

with said direction-dependent colors of a direction of said diffusion process" as recited in claim 1. Appellants assert that Laidlaw, at best, teaches a scalar quantity but fails to teach a vector quantity that includes an indication with the colors of a direction of the diffusion process as one of the vectorial quantities as recited. *See* App. Br. 13-14. Yet, Laidlaw teaches using a transfer function to specify color and the transfer function has three scalars as inputs, including one having a directional component (e.g., a directional second derivative). ¶ 0141; *see also* Ans. 33-35. Laidlaw further discusses that the transfer function can take a 2D (i.e., a vector) form and can be used to specify the color. *See* ¶¶ 0057, 0085, 0111, 0123. Laidlaw thus teaches vectorial quantities (e.g., 2D transfer functions) that are represented in colors in a multi-dimensional projected color-coded representation and suggests the colors are direction-dependent given that one of the scalars in the transfer function is a *directional* second derivative. *See id.*; *see also* ¶ 0141.

Laidlaw further teaches or suggests that the vectorial quantities include an indication with the direction-dependent colors of a direction of a diffusion process as recited in claim 1. For example, Laidlaw teaches that the color for the direct-volume-rendered layer can be specified through a transfer function based anistropy metrics. ¶ 0141. Appellants contend that this teaches a scalar quantity incapable of providing directional information. *See* App. Br. 14-15. We disagree. First, as discussed above, the transfer function can be a 2D transfer function (e.g., a vector function), and Laidlaw states the function can be based on anistropy metrics or multiple metrics. ¶ 0141; Fig. 10.

Second, claim 1 broadly recites that vectorial quantities are to be represented in different direction-dependent colors including an *indication of*

a direction of a diffusion process, but does not specify what the indication may be or define the type of direction. *See also* Ans. 30-31 (discussing that the claim does not recite that the "color is associated with each possible direction of the three-dimensional vector"). Thus, the terms in Laidlaw, such as "isotropy" indicating no directional preference[2] and "anisotropy" indicating a directional preference in the linear or planar direction (¶ 0141), are an indication or a sign of a directional preference of the diffusion process (e.g., a linear or planar direction). Moreover, each of these directions is associated with a color. *See id.* Laidlaw also teaches a green and blue channel of a 3D texture may hold two MRI diffusion anisotropy metrics and may be used as coordinates for a texture lookup into the texture of 2D barycentric transfer function, which outputs a color and opacity for the current fragment based on diffusion anisotropy. ¶ 0111.

Lastly, and as noted by the Examiner (Ans. 31, 36, 40-41), Laidlaw also teaches quantities, such as a 3D velocity vector field and vorticity vector field, that are also represented by a color and suggest that color also *indicates* or is sign of a direction of the diffusion process. *See* ¶¶ 0147-50. Thus, Laidlaw further suggests other vectorial quantities that have direction-dependent colors in a multi-dimensionally projected color-coded representation as broadly as recited. We, therefore, disagree that the colors in Laidlaw are already being used to provide information other than direction information and cannot be modified to represent direction information as argued by Appellants. App. Br. 16.

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[2] *See isotropy*, MERRIAM-WEBSTER ONLINE DICTIONARY (11th ed.), *available at* http://www.merriam-webster.com/dictionary/isotropy.

2. Kindlmann/Witwer in Combination with Laidlaw

The Examiner finds that that Laidlaw does not specifically teach generating said multi-dimensionally projected color coded representation to comprise primary directions, and color coding said primary directions respectively with primary colors ("element [c]"). Ans. 6. The Examiner turns to Kindlmann and Witwer to cure this deficiency (Ans. 7-8) and to modify Laidlaw to include Kindlmann's and Witwer's teachings to teach element [c] (Ans. 10-11). Appellants argue that Laidlaw should not "be considered as a 'candidate' for modification by the other references." App. Br. 16. Specifically, Appellants contend that, since Laidlaw fails to teach or suggest different anisotropy directions are associated with colors, Kindlmann cannot be combined with Laidlaw. *See id.* Because we find that Laidlaw teaches and suggests an indication of the diffusion process direction with direction-dependent colors as stated above, we disagree.

Also, Appellants argue Kindlmann is "in contrast to the subject matter disclosed and claimed in the present application" (App. Br. 17) and to Witwer, where components of the largest eigenvector are associated with various color components (*id.*). We find this argument unavailing. Notably, Appellants do not specifically argue any claim element recited in claim 1 that Kindlmann fails to teach or suggest. *See* App. Br. 16-17. Also, claim 1 does not include a limitation addressing eigenvectors associated with color components or that the directional association with a color is based on vector where an absolute orientation is specified (*see id.*). Thus, these arguments are not commensurate in scope with claim 1.

Appellants argue additionally that "there is no point of commonality among any of these references, much less any guidance that a person of

ordinary skill in the field of image presentation would be able to obtain from reading those references . . . .." App. Br. 17. Yet, Appellants have not presented any support to demonstrate this contention. On the other hand, the Examiner relies upon Kindlmann to teach visualizing vectors using a color map that maps direction, including anistropic directions to a color (*see* Ans. 7-8, 25-26, 43) and Witwer to teach mapping anistotropic directions to red, green, and blue (i.e., coding of primary directions) (*see* Ans. 8, 26, 43, 48). This shows that both Kindlmann and Witwer were aware of presenting body images using color, similar to Laidlaw. Appellants further admit that Kindlmann teaches associating color with a direction using a hue ball. App. Br. 16-17; *see* Ans. 7-8 (citing §§ 3.1-3.3). Moreover, the Examiner concludes that modifying Laidlaw to include Kindlmann's and Witwer's teaching teaches or suggests element [c] so as to visualize distinct regions in a simplified manner. *See* Ans. 10-11, 25, 45-46. That is, including such features taught by Kindlmann and Witwer into Laidlaw colored images would predictably yield no more than one would expect. *See KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007). Appellants fail to rebut sufficiently these findings and conclusions. *See* App. Br. 16-17.

3. The Remaining Teachings

Appellants argue that Schrag fails to discuss a color-coded directional specifications or indicating a presentation of orientation in color. App. Br. 17-18. Yet, the Examiner has relied upon Kindlmann, Witwer, and Schrag, when combined with Laidlaw to teach element [d] concerning the color-coded representation to comprise primary directions and the orientation of the presentation with respect to a multiple direction-indicating

axes. *See* Ans. 7-8, 25-26. Moreover, Schrag teaches the recited "at least one explanatory specification" feature recited in claim 1 having a compass to indicate orientation and direction. *See* Ans. 7-11, 44 (citing ¶¶ 0025, 0028, 0040; Figs. 2, 14). Appellants also argue that Schrag has no indication of using a 3D compass in presenting medical data, further suggesting that using this teaching would not be obvious to one skilled in the image presentation art. App. Br. 17-18. Nonetheless, Schrag solves a similar problem to Appellants by including an explanatory specification or legend (e.g., the compass) to indicate orientation and direction in a 3D scene. *Compare* Spec. 9:3-17; 10:4-11 *with* Schrag, ¶ 0008. We, therefore, are not persuaded that one skilled in the art would not have combined Schrag's teaching with Laidlaw's 3D scene.

The Examiner relies upon Tory to teach primary directions are color coded to indicate orientation of a cutting plane (e.g., a slice position). *See* Ans. 9, 11, 26, 50. Appellants assert that the orientation icons in Tory are no more than designation of a presentation type and the orientation elements do not correspond to "the language of the claims of the present application." App. Br. 18. Yet, Appellants do not specifically point out what "language of the claims" Tory fails to teach or suggest. *See id.* Given the lack of specificity concerning the claim language Tory fails to teach, we find Appellants' arguments unpersuasive.

Lastly, the Examiner relies upon Fenster to teach a multi-dimensional projected representation comprising primary colors and providing cross-sectional views of the multi-dimensional image that indicate the orientation of the representation with respect to multiple direction-indicating axes. *See* Ans. 9-11, 27, 49-51. Appellants argue that

Fenster does not provide a teaching beyond those in Schrag, which is only a directional indication tool. App. Br. 19. We disagree and refer to the Examiner's undisputed findings concerning what Fenster teaches.

For the foregoing reasons, Appellants have not persuaded us of error in the rejection of independent claim 1 and claims 3-5 and 7-14 not separately argued with particularity.

CONCLUSION

The Examiner did not err in rejecting claims 1, 3-5, and 7-14 under § 103.

DECISION

The Examiner's decision rejecting claims 1, 3-5, and 7-14 is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED

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